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EPIDEMIC OF DENDROCTONUS MONTICOLAE RESULTING FROM BROODS BREEDING IN SUGAR PINE SLASH - BIG CREEK BASIN STANISLAUS NATIONAL FOREST, CALIFORNIA

By

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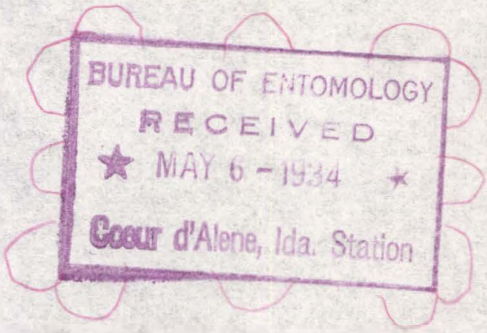

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Foreword:

Epidemic infestations in standing timber have for some time been known to occur under certain conditions as a result of broods of barkbeetles breeding in certain types of pine slash.

Previous studies* made by the Bureau of Entomology have shown that an increase in infestations in standing timber may occur within a year after logging slash, line slash or road right-of-way slash has been made. Wind fallen timber, while not slash, per se, falls in this same class. Such infestations may at times follow cessation of logging operations; particularly when these operations are shut down during the summer months. The intensity of these infestations is directly proportionate to the distance the affected stands are from the slash. These studies have also shown that slash consisting of the larger sections of green logs and tops are more favorable to brood development than other types of slash, and consequently produce larger broods. Subsequent infestations in adjacent standing timber are higher as a result of broods breeding in slash of this character.

A recent study of an epidemic infestation of Dendroctonus monticolae in sugar pine (Pinus lambertiana), which followed emergence from logging slash, has resulted in securing highly interesting data on slash infestations and on this area was the source of an epidemic infestation in adjacent standing timber.

Other insects associated with Dendroctonus monticolae in this infestation were the engraver beetles, Ips spp, and flat-head bark-borers, Melanophila spp. However, these species were largely confined to the tops of large trees and to the pole stands, and consequently of secondary importance in the infestation.

The study was made in the Big Creek Basin, near Hazel Green, on the Stanislaus National Forest, during the summer and fall seasons of 1933. It was carried out in connection with an E.C.W. survey of this region which made it possible to secure loss data in the surrounding timber stands without extra cost or time.

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*Literature cited, page 6.

The Area:

The area involved in this study comprises about 5 sections, or 3,000 acres, of Site 1 ponderosa pine and sugar pine in a well isolated basin on the headwaters of Big Creek. This stand is almost pure sugar pine type: at least 90% of the merchantible timber being of this species. Other species associated in the stand in a minor degree are incense cedar, ponderosa pine, white fir, Douglas fir, and Kellogg oak. There is considerable brush in the understory. The topography is unusually rugged with steep slopes, sharp ridges, and deep stream channels. The elevations range from 4,300 feet to 5,500 feet.

The Slash:

The slash consists mainly of "long-butts", cull logs and tops, as well as entire trees some of which had been bucked into cants, while others had not been limbed.

Men who had been employed on this logging operation reported that work was shut down suddenly without attempt being made to clean up logs not yet yarded.

Fully 90% of the timber cut was sugar pine. Considerable breakage had occurred in falling with the result that an unusually large portion of body chunks was left as slash; even on those areas where the merchantible cants had been removed. The photo A, on page 6, shows a typical cull butt cant. The photo B, on same page, shows an entire tree which had been bucked but not removed. The type of slash illustrated in these photos is very attractive to Dendroctonus beetles, and contrary to slash of smaller dimensions, brood development is not adversely affected. The photo B also illustrates the usual heavy understory, composed of young trees and brush, which is prevalent throughout the slash area. This dense understory was inducive to normal brood development with resultant average progeny of adult beetles as it protected the infested logs from direct sunlight which would otherwise cause high mortality during brood development.

The trees felled were all of merchantible size and ranged from 18" to 82" diameter at stump height. The maximum volume of the largest tree scaled was 18,300 board feet. Since the slash was composed almost wholly of sugar pine; and the attack on the slash and also the subsequent infestations in the adjacent standing timber was 90% Dendroctonus monticolae in this species, only this host and beetle were studied.

The slash covered an area of approximately 640 acres. Several check areas, totalling 160 acres, were carefully examined and all the slash on each was scaled. This amounted to a total of 301,000 board feet. Because the check areas carefully examined were representative of the entire slash the data secured on them are highly comparable to the whole. Assuming that this is so, the total slash amounted to 866,000

board feet. Quite a sizable infestation since practically all this slash was attacked and normal broods were developed.

The position of the slash in relation to the subsequent infestation in standing trees is shown on the maps, page 8. Reference to these maps will show that the slash is on a long and narrow strip at the edge of a previously logged area which covered a large section on the Big Creek watershed. Bordering the slash on three sides are virgin stands of timber of maximum age and growth. These were all optimum conditions favoring the beetles, which was later shown by the epidemic developed.

The slash itself is on north and west exposures with the drainage leading away from it and through the adjoining uncut stands. With the exceptions of the extreme eastern and western limits of these adjacent stands, the subsequent infestations were all in elevations lower than the slash.

The slash was made in the late fall and early winter of 1930 and in the winter and early spring of 1931. Since it was all fresh during the first period of attack in the spring of 1931 it was infested at that time. Following brood development and emergence - there being no more slash to attack - the emerged beetles attacked the adjacent living trees.

Attack of Slash and Brood Development:

While there is no criteria of normal attack or subsequent emergence of Dendroctonus monticolae broods in sugar pine at hand for this area, close examination of the slash indicated that the attack was average in intensity per unit of log area and that brood development had been normal for this type material as compared with data from other regions. Egg galleries were of the usual length and spacing, while the prevalence of pupal cells attested that the normal ratio of adult beetles had developed. The subsequent seasonal beetle population on the area supported this evidence.

Attack of Adjacent Standing Timber:

The first concerted attacks in the adjoining standing timber occurred in the summer and fall of 1931 following emergence of the earlier seasonal broods from the slash. Subsequent generations, or broods, in the year following continued to infest these stands.

Amount of Loss in Adjacent Standing Timber:

No exact figures on the amount of infestation existing in the adjoining timber prior to the slash were secured. Such figures could not be obtained with any degree of accuracy in 1933 since it was not possible to definitely date the old loss. However, the obvious scarcity of old trees and snags killed previous to the fall period of 1931 showed

conclusively that the beetle loss in these stands had been relatively low. It is believed that these losses were not higher than the 1933 loss which was definitely determined and shown in a succeeding paragraph. The attack of the slash undoubtedly occurred as a consequence of the concentration of beetles largely from the surrounding region.

The late 1931 infestation, which developed from the first attacks following emergence from the slash, was concentrated within a zone immediately adjacent to the slash. This same status was maintained throughout the following season of 1932. These concentrated infestations did not extend more than one-half mile from the slash. They are shown graphically in the "intensive zone" on the maps, page 8. It will be noted that the more remote infestations were not appreciably affected by the infestations in the intensive zone.

The concentrated infestation in the intensive zone had greatly subsided by 1933, and during that year was not greater than that in the remote areas. Thus, the cycle was completed and, within two years, normal conditions again prevailed. Such is the usual history of infestations that develop from slash. In this case, however, the cycle was of somewhat shorter duration than usual. The reason for this comparatively short cycle was clearly manifested on this area since the higher epidemic infestations of 1931 and 1932 had resulted in the widespread depletion of the sugar pine stands in the areas bordering the slash. Another reason, which no doubt had some bearing, was the general decline in D. M. infestations throughout the middle Sierras. The same influences which caused this general subsidence were, no doubt, operative in these stands.

The annual infestations in sugar pine during the three years, 1931, 1932, and 1933, are shown in the following table:

Year	Intensive Zone		Remote Zone		Both Zones (Total)	
	Trees	Volume B.F.	Trees	Volume B.F.	Trees	Volume B.F.
1931	333	1,931,400	15	103,500	348	2,034,900
1932	380	1,550,400	27	172,340	407	1,722,740
1933*(Marked)	34	103,620	10	40,400	44	144,020
Estimated Total for 1933	57	172,700	17	67,330	73	240,030

*Note: The survey of the 1933 losses was made in August of that year when only about 60% of the year's loss could be recorded. The total loss for this year has been computed by applying a known factor applicable for the date of the survey, for the same year.

The progress of the infestation, as shown by the loss figures in the above table, assuming that the loss in 1930 approximated that of 1933, has been about as follows:

It can be definitely stated that the infestation during the year 1930 was normal for this region and is therefore considered static

for these stands. Then the abnormal increase in the areas adjoining the slash during 1931, the year of slash breeding and first subsequent attack of adjacent stands, can be accounted for only as a direct result of high concentration of beetle population in the immediate vicinity of the slash, and also as a result of breeding up in the slash itself. This increase amounted to 484% in terms of number of trees, and 1,018% in board feet in the intensive zone.

Nearly the same status continued through 1932 with a slight increase in number of trees but a corresponding slight decrease in volume. By 1933 the infestation in this zone had dropped to normal and the flare-up was at an end.

It will be noted that this same trend was not followed in the remote areas. The infestation in 1931 in the remote zone was actually less in number of trees (12%) and only 54% greater in volume. There was not much change in 1932. Considering the limitations of the study these slight differences become negligible; and it may be stated that the outlying infestations remained static. However, figures resulting from surveys made throughout the central Sierran region show that there was a general increase in the infestations of 1931 and 1932. Because these remote regions did not show this is additional proof that the bulk of the infestation was concentrated in the slash and in its immediate vicinity.

Conclusions:

The results of this study warrant the following conclusions:

Cull logs, butt cants, and broken sections of trunks of sugar pine are especially attractive to the mountain pine beetle; and that slash of this character is favorable breeding material for these beetles.

Mortality is relatively low in broods developing in slash that is well protected from the sun by dense brush cover and thick understory such as was prevalent on this area.

That a flare-up in infestation in standing timber may be expected when logging operations are suddenly stopped. That such increased infestations occur in the immediate vicinity of the slash; and that there is an actual reduction in losses in more remote areas.

That it is hazardous to leave entire trees, or any other large amount of breeding material as was done in this operation; since broods breeding in such material develop normal progeny and greatly increase the beetle population.

The greatly increased epidemic infestation was of short duration in this case and it followed the same cycle as other slash infestations previously studied.

On this area the epidemic subsided within two years.

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A - Cull butt-cant of sugar pine log 5 feet in diameter and 20 feet long. Such cants were common on the logged area since the majority of the trees were past maturity and had developed sufficient defects to constitute cull. They were heavily attacked by the mountain pine beetle, as is evidenced by the egg galleries on the blazed section. That they developed normal broods was evidenced by the prevalence of pupal cells under the bark.

B - An entire sugar pine tree felled and bucked but not removed. These were common on parts of the cutting area and represented the greater volume of slash left. The dense understory of brush and small trees shown here is characteristic of the slash area and was a major factor favoring normal development of the broods since it protected the infested logs from the direct rays of the sun.

C - Dead sugar pine trees bordering the slash. This photograph shows a part of a group of 67 large trees which was killed in 1932. The foliage was red when this picture was taken in September, 1933.

R 19 E

REMOTE ZONE

7 8 9

INTENSIVE ZONE

T 2 S

SLASH

SLASH

17

18

CUTOVER

BIG CREEK SLASH INFESTATION

1931 INFESTATION

Boundary of cutover

Boundary between intensive and remote zones

Boundary of recent slash

x Sugar Pine

• Ponderosa Pine

Scale: 4" = 1 mi.

R. 19 E.

REMOTE ZONE

7 8 9

INTENSIVE ZONE

T. 2 S.

SLASH

SLASH

17

18

CUTOVER

BIG CREEK SLASH INFESTATION

1932 INFESTATION

Boundary of cutover

Boundary between intensive and remote zones

Boundary of recent slash

x Sugar Pine

• Ponderosa Pine

Scale: 4" = 1 mi.

R. 19 E.

REMOTE ZONE

7 8 9

INTENSIVE ZONE

T. 2 S.

SLASH

SLASH

17

18

CUTOVER

BIG CREEK SLASH INFESTATION

1933S INFESTATION

Boundary of cutover

Boundary between intensive and remote zones

Boundary of recent slash

x Sugar Pine

• Ponderosa Pine

Scale: 4" = 1 mi.